



Europäisches Patentamt
European Patent Office
Office européen des brevets



(11)

EP 0 716 245 B1

(12)

EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention
of the grant of the patent:
15.03.2000 Bulletin 2000/11

(51) Int Cl.7: **F16D 65/08**

(21) Application number: **95306755.0**

(22) Date of filing: **25.09.1995**

(54) **Drum brake assembly**

Trommelbremsenaufbau

Ensemble d'un frein à tambour

(84) Designated Contracting States:
DE FR GB

(30) Priority: **05.12.1994 US 349574**

(43) Date of publication of application:
12.06.1996 Bulletin 1996/24

(73) Proprietors:

- **FORD MOTOR COMPANY LIMITED**
Brentwood, Essex CM13 3BW (GB)
Designated Contracting States:
GB
- **Ford-Werke Aktiengesellschaft**
50735 Köln (DE)
Designated Contracting States:
DE
- **FORD FRANCE S. A.**
92506 Rueil-Malmaison Cédex (FR)
Designated Contracting States:
FR

(72) Inventor: **Jackson, Mark Hollis**
Dearborn Heights, Michigan 48127 (US)

(74) Representative: **Messulam, Alec Moses et al**
A. Messulam & Co.
24 Broadway
Leigh-on-Sea Essex SS9 1BN (GB)

(56) References cited:
DE-A- 3 109 992 **US-A- 4 773 512**

- **PATENT ABSTRACTS OF JAPAN** vol. 016 no. 122 (M-1226) ,27 March 1992 & JP-A-03 288028 (HINO MOTORS LTD) 18 December 1991,
- **PATENT ABSTRACTS OF JAPAN** vol. 006 no. 196 (M-161) ,5 October 1982 & JP-A-57 103941 (AKEBONO BRAKE IND CO LTD) 28 June 1982,

BEST AVAILABLE COPY

EP 0 716 245 B1

Note: Within nine months from the publication of the mention of the grant of the European patent, any person may give notice to the European Patent Office of opposition to the European patent granted. Notice of opposition shall be filed in a written reasoned statement. It shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).

Description

Field of the Invention

[0001] This invention relates generally to a drum 5
brake assembly for motor vehicles.

Background of the invention

[0002] Drum brake designers have directed significant effort towards reducing the generation of objectionable noise generated during braking application. Recently, as exemplified by U.S. Patent 4,773,512, some of this effort has been directed to examining the contribution of the internal brake shoe to the generation of this noise or squeal. The '512 patent discloses non-uniform stiffening and reinforcing of the brake shoe to shift its natural frequency beyond that of the frequency of the objectionable noise being generated. Practising this involves accurately placing several reinforcements between the brake shoe web and the table, or alternatively utilising new blanks for the table to provide upturned flanges.

Object of the invention

[0003] The present invention seeks to reduce the objectionable noise generated by brake shoes in a drum brake assembly without requiring new blanks for the table or requiring precision positioning and welding of reinforcements at the intersection of the web and the table.

Summary of the invention

[0004] The present invention provides a brake shoe 35
for a drum brake assembly, including a mass damper attached to the brake shoe for reducing objectionable noises emanating therefrom.

[0005] In accordance with the present invention, there is provided a brake shoe for use in a drum brake of a motor vehicle, said brake shoe comprising:

an arcuate table having inner and outer peripheries;
a web fixed to the inner periphery of said table substantially midway between opposite arcuate edges of said arcuate table;
a lining secured to said outer periphery of said table, said lining being operative to effect braking contact with a brake drum;

characterised in that;

a mass damper is fastened to the arcuate table in a position on said inner periphery of said arcuate table adjacent to an arcuate edge and close to an anti-node of the arcuate table, said mass damper providing a concentrated location of mass operative to attenuate torsional vibration of said brake shoe and thereby reduce objectionable noises emanating therefrom.

[0006] It is an advantage of the mass damper that it attenuates torsional vibration of the brake shoe and thereby reduces objectionable noises emanating therefrom.

Brief description of the drawings

[0007] The invention will now be described further, by way of example, with reference to the accompanying drawings, in which :-

FIG. 1 is an exploded view of an internal drum brake assembly having brake shoes fitted with mass dampers according to the present invention,

FIG. 2 is a perspective view of a brake shoe having a mass damper according to the present invention, FIG. 3 is a perspective view of a mass damper in the form of an arcuate plate according to the present invention,

FIG. 4 is a perspective view of an alternative embodiment of a brake shoe requiring two mass dampers according to the present invention,

FIG. 5 is a sectional view taken from Fig. 2 showing an arcuate table undergoing a flutter mode of vibration, and

FIG. 6 is a sectional view taken from Fig. 3 showing a mass damper disposed along an arcuate edge of an arcuate table to attenuate a flutter mode of vibration according to the present invention.

Detailed description of the preferred embodiments

[0008] Referring now to the figures, FIG. 1 illustrates a drum brake assembly 10 for a motor vehicle. The drum brake assembly 10 includes a brake backing plate 12 having a primary brake shoe 14 and a secondary brake shoe 16 pivotally secured to the backing plate 12 by steady rest springs 18, 20 and pins 22, 24. An anchor pin 26 is rigidly attached to the backing plate 12. A brake drum 28 surrounds the brake shoes 14, 16 in spaced relation and attaches to a rotating wheel assembly (not shown). Brake linings 30, 32 on the brake shoes 14, 16 are moved against an inner surface of the brake drum 28 by a wheel cylinder 34 for frictionally stopping the motor vehicle.

[0009] FIG. 2 illustrates the primary brake shoe 14, which will now be described, it being understood that the secondary brake shoe 16 is a mirror image of the primary brake shoe 14 for the purposes of this description. The brake shoe 14 includes an arcuate table 40 having a web 46 fixed to an inner periphery 42 substantially midway between opposite arcuate edges 48, 50 of the arcuate table 40. The arcuate table 40 further includes an outer periphery 44 to which the lining 30 is fixed between first and second ends 52, 54 of the arcuate table 40. The brake shoe 14 also includes a mass damper, shown in the presently preferred form of an arcuate plate 60, fixed to the inner periphery 42 of the ar-

uate table 40.

[0010] Referring to Figs. 2 and 3, the mass damper provides a concentrated location of mass, that may be shaped as required for packaging the neighbouring components within the drum brake assembly 10. In the preferred embodiment, the arcuate plate 60 includes inner and outer peripheries 62, 64 about one quarter of an inch (6.5 mm) apart and parallel to the inner periphery 42 of the arcuate table 40. The arcuate plate 60 further includes opposite arcuate edges 66, 68 about one inch (25 mm) apart and first and second ends 70, 72 about two and a half inches (63 mm) apart. The present invention is not so limited, however, as various shaped slugs of material are contemplated for conforming within the limited space available in the drum brake assembly 10. One such example contemplated includes a cylindrical body having one end resiliently attached to the internal periphery 42 of the arcuate table 40.

[0011] A protuberance 74 projects from the outer periphery 64 of the arcuate plate 60 toward the inner periphery 42 of the arcuate table 40. In the preferred embodiment, the arcuate plate 60 is stamped from mild steel, which allows the protuberance 74 to be projection welded to the inner periphery 42 of the arcuate table 40 when constructed from a weld compatible material. This provides the most cost effective manner of attaching the mass damper to the arcuate table 40, however, the present invention is not so limited. Alternative fastening techniques may be required for materials not capable of welding. For example, the mass damper may be bonded, riveted or secured by a threaded fastener while providing the equivalent function and operability.

[0012] Referring now to Figs. 5 and 6, the position of the mass damper on the arcuate table 40 is preferably determined through testing the drum brake assembly 10. Generally, when an objectionable noise, in the frequency range of 8-14 khz, emanates from the drum brake assembly 10 during operation it can be traced, at least in part, to a torsional vibration mode of the brake shoe 14. This vibration mode is characterised in that the arcuate table 40 undergoes what is referred to as flutter. At a characteristic frequency unique for each drum brake design, the opposite arcuate edges 48, 50 at a particular point between the first and second ends 52, 54 of the arcuate table 40 experience an out-of-phase sinusoidal displacement. This point is referred to as an anti-node. As shown in Fig. 6, it is desirable to place the mass damper as close to the anti-node as possible to accomplish the greatest attenuation of the flutter, thereby reducing the noise emanating therefrom.

[0013] Referring to Figs. 2 and 3, testing has indicated that for a brake shoe 14 having an arcuate table 40 being twelve inches (30 cm) between first and second ends 52, 54 and three inches (7.5 cm) between opposite edges 48, 50, the arcuate plate 60 is best positioned midway between the first and second ends 52, 54 adjacent to one of the opposite edges, 48, 50. As can be seen in Fig. 5, for a brake shoe 14 having an arcuate table 40

being twelve and one eighth inches (30.8 cm) between first and second ends 52, 54 and three and one-half inches (3.9 cm) between opposite edges 48, 50, two arcuate plates 60 are preferred. A first arcuate plate is positioned substantially midway between a first end 52 and a midpoint 56 of the arcuate table 40, and a second arcuate plate 60 is positioned substantially midway between a second end 54 and the midpoint 56 of the arcuate table 40.

Claims

1. A brake shoe for use in a drum brake (10) of a motor vehicle, said brake shoe comprising:

an arcuate table (40) having inner and outer peripheries;
a web (46) fixed to the inner periphery of said table (40) substantially midway between opposite arcuate edges (48,50) of said arcuate table (40);
a lining (30) secured to said outer periphery of said table (40), said lining (30) being operative to effect braking contact with a brake drum (28);

characterised in that;

a mass damper (60) is fastened to the arcuate table (40) in a position on said inner periphery of said arcuate table (40) adjacent to an arcuate edge (50) and close to an anti-node of the arcuate table (40), said mass damper (60) providing a concentrated location of mass operative to attenuate torsional vibration of said brake shoe (14) and thereby reduce objectionable noises emanating therefrom.

2. A brake shoe as claimed in claim 1, wherein said mass damper (60) comprises an arcuate slug fastened midway between first and second ends (52,54) of said arcuate table (40).
3. A brake shoe as claimed in claim 1, wherein said mass damper (60) comprises a first arcuate slug fastened substantially between a first end (52) and a midpoint (56) of said arcuate table (40), and a second arcuate slug fastened substantially midway between a second end (54) and said midpoint (56) of said arcuate table (40).
4. A brake shoe as claimed in any preceding claim, wherein said mass damper (60) is projection welded to said arcuate table (40).
5. A brake shoe as claimed in claim 2 or 3, wherein the or each arcuate slug comprises:

an arcuate plate (60) having inner (62) and outer (64) peripheries parallel to the said inner and

- outer peripheries of said arcuate table (40); a protuberance (74) projecting from said outer periphery (64) of said arcuate plate (60) toward said inner periphery of said arcuate table (40), said protuberance adapted to be projection welded to said arcuate table (40).
6. A brake shoe as claimed in claim 5, wherein said arcuate plate (60) is constructed from mild steel.
7. A brake shoe as claimed in claim 5 or 6, wherein said arcuate plate (60) comprises;

opposite arcuate edges about one inch (2.5 cm.) apart, first and second ends (70,72) about one and one-half inches (3.8 cm.) apart; and said inner and outer peripheries (62,64) being about one quarter of an inch (6.5 mm.) apart.

Patentansprüche

1. Eine Bremsbacke zur Anwendung in einer Bremsstrommel (10) eines Kraftfahrzeugs, wobei die besagte Bremsbacke enthält:

eine bogenförmige Platte (40) mit einem Innen- und einem Aussenrand;

einen Arm (46), der am Innenrand der besagten Platte (40) im wesentlichen auf halbem Weg zwischen den gegenüberliegenden, bogenförmigen Kanten (48, 50) der besagten bogenförmigen Platte (40) befestigt ist;

einen Belag (30), der an dem besagten Aussenrand der besagten Platte (40) befestigt ist, wobei der besagte Belag (30) einwirkt, um den Bremskontakt mit einer Bremsstrommel (28) herzustellen;

dadurch gekennzeichnet dass:

ein Massedämpfer (60) an der bogenförmigen Platte (40) in einer Stellung auf dem besagten Innenrand der besagten bogenförmigen Platte (40) nahe zu einer bogenförmigen Kante (50) und nahe zu einem Knotenschutz der bogenförmigen Platte (40) befestigt ist, wobei der besagte Massedämpfer (60) eine konzentrierte Stelle der Masse liefert, die einwirkt, um die Drehschwingung der besagten Bremsbacke (14) zu verringern und dadurch unakzeptierbare, von ihr kommende Geräusche zu reduzieren.

2. Eine Bremsbacke nach Anspruch 1, in der der besagte Massedämpfer (60) eine bogenförmige Stange enthält, die auf halbem Weg zwischen einem ersten und einem zweiten Ende (52, 54) der besagten

bogenförmigen Platte (40) befestigt ist.

3. Eine Bremsbacke nach Anspruch 1, in der der besagte Massedämpfer (60) eine erste bogenförmige Stange enthält, die im wesentlichen zwischen einem ersten Ende (52) und einem Mittelpunkt (56) der besagten bogenförmigen Platte (40) befestigt ist und eine zweite bogenförmige Stange, die im wesentlichen auf halbem Weg zwischen einem zweiten Ende (54) und dem besagten Mittelpunkt (56) der besagten bogenförmigen Platte (40) befestigt ist.

4. Eine Bremsbacke nach irgendeinem der vorhergehenden Ansprüche, in der der besagte Massedämpfer (60) an die besagte bogenförmige Platte (40) buckelgeschweisst ist.

5. Eine Bremsbacke nach Anspruch 2 oder 3, in der die oder jede bogenförmige Stange enthält:

ein bogenförmiges Blechs (60) mit einem Innen- (62) und einem Aussenrand (64), die parallel zum besagten Innen- und Aussenrand der besagten bogenförmigen Platte (40) sind;

einen Vorsprung (74), der aus dem besagten Aussenrand (64) des besagten bogenförmigen Blechs (60) zum besagten inneren Rand der besagten bogenförmigen Platte (40) hervorragt, wobei der besagte Vorsprung geeignet ist, um auf die besagte bogenförmige Platte (40) buckelgeschweisst zu werden.

6. Eine Bremsbacke nach Anspruch 5, in der das besagte bogenförmige Blechs (60) aus Flusstahl hergestellt ist.

7. Eine Bremsbacke nach Anspruch 5 oder 6, in der das besagte bogenförmige Blech (60) enthält:

gegenüberliegende, bogenförmige Kanten, die etwa ein inch (2,5 cm) voneinander entfernt sind,

ein erstes und ein zweites Ende (70, 72), die ungefähr eineinhalb inch (3,8 cm) voneinander entfernt sind und

den besagten Innen- und Aussenrand (62, 64), die ungefähr ein Viertel inch (6,5 mm) voneinander entfernt sind.

Revendications

1. Mâchoire de frein destinée à être utilisée dans un frein à tambour (10) d'un véhicule à moteur, ladite

mâchoire de frein comprenant

une semelle en arc de cercle (40) présentant des périphéries interne et externe, une âme (46) fixée à la périphérie interne de ladite semelle (40) pratiquement à mi-chemin entre des bords opposés en arc de cercle (48, 50) de ladite semelle en arc de cercle (40), une garniture (30) fixée à ladite périphérie externe de ladite semelle (40), ladite garniture (30) pouvant être mise en oeuvre afin d'établir un contact de freinage avec un tambour de frein (28),

caractérisé en ce que

un amortisseur à masse (60) est fixé à la semelle en arc de cercle (40) en un emplacement sur ladite périphérie interne de ladite semelle en arc de cercle (40) adjacent à un bord en arc de cercle (50) et proche d'un antinœud de la semelle en arc de cercle (40), ledit amortisseur à masse (60) procurant un lieu concentré de masse agissant pour atténuer les vibrations de torsion de ladite mâchoire de frein (14) et réduire ainsi des bruits désagréables émanant de celle-ci.

2. Mâchoire de frein selon la revendication 1, dans laquelle ledit amortisseur à masse (60) comprend un bloc en arc de cercle fixé à mi-chemin entre des première et seconde extrémités (52, 54) de ladite semelle en arc de cercle (40).

3. Mâchoire de frein selon la revendication 1, dans laquelle ledit amortisseur à masse (60) comprend un premier bloc en arc de cercle fixé pratiquement entre une première extrémité (52) et un point milieu (56) de ladite semelle en arc de cercle (40), et un second bloc en arc de cercle fixé pratiquement à mi-chemin entre une seconde extrémité (54) et ledit point milieu (56) de ladite semelle en arc de cercle (40).

4. Mâchoire de frein selon l'une quelconque des revendications précédentes, dans laquelle ledit amortisseur à masse (60) est soudé par bossages à ladite semelle en arc de cercle (40).

5. Mâchoire de frein selon la revendication 2 ou 3, dans laquelle le bloc ou chaque bloc en arc de cercle comprend :

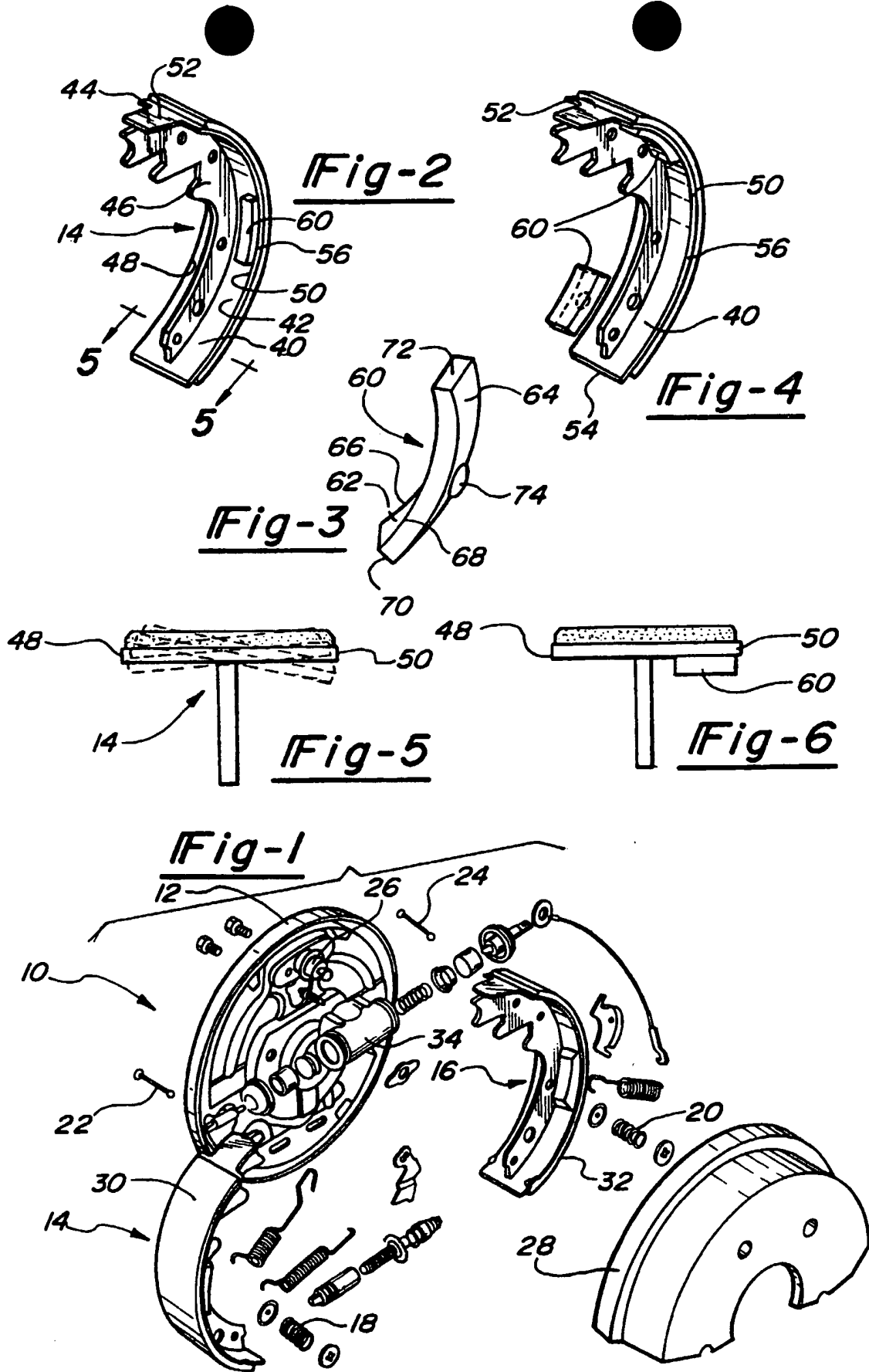
une plaque en arc de cercle (60) présentant des périphéries interne (62) et externe (64) parallèles auxdites périphéries interne et externe de ladite semelle en arc de cercle (40), une protubérance (74) s'étendant depuis ladite périphérie externe (64) de ladite plaque en arc de cercle (60) en direction de ladite périphérie

interne de ladite semelle en arc de cercle (40), ladite protubérance étant conçue pour être soudée par bossage à ladite semelle en arc de cercle (40).

6. Mâchoire de frein selon la revendication 5, dans laquelle ladite plaque en arc de cercle (60) est construite à partir d'acier doux.

7. Mâchoire de frein selon la revendication 5 ou 6, dans laquelle ladite plaque en arc de cercle (60) comprend,

des bords opposés en arc de cercle espacés d'environ un pouce (2,5 cm), des première et seconde extrémités (70, 72) espacées d'environ un pouce et demi (3,8 cm), et lesdites périphéries interne et externe (62, 64) étant espacées d'environ un quart de pouce (6,5 mm).



**This Page is Inserted by IFW Indexing and Scanning
Operations and is not part of the Official Record**

BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

- ☐ BLACK BORDERS
- ☐ IMAGE CUT OFF AT TOP, BOTTOM OR SIDES
- ☒ FADED TEXT OR DRAWING
- ☒ BLURRED OR ILLEGIBLE TEXT OR DRAWING
- ☐ SKEWED/SLANTED IMAGES
- ☐ COLOR OR BLACK AND WHITE PHOTOGRAPHS
- ☐ GRAY SCALE DOCUMENTS
- ☒ LINES OR MARKS ON ORIGINAL DOCUMENT
- ☒ REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY
- ☐ OTHER: _____

IMAGES ARE BEST AVAILABLE COPY.

As rescanning these documents will not correct the image problems checked, please do not report these problems to the IFW Image Problem Mailbox.